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Research Article

Data Management and Marketing Methods of Interactive Video Websites in the Era of Big Data

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With the continuous development of the Internet, the explosive growth of network information, and the continuous increase of the bandwidth available to individual users, network video content has gradually become the most abundant and largest information group on the Internet. In the process of Internet video management, it can be transformed into the relationship between the three entities. Video resource management system of the business, meanwhile, with the increasingly rich, two more associated business interfaces, the interface between the relationships becomes more complex, resulting in the coupling between the business modules. The traditional module interface interaction pattern is difficult to adapt to changing business needs. The system can meet the needs of users with better data exchange, so it can improve the scalability of the system to a certain extent. In addition, third-party regulatory authorities will require video service providers to check the copyright of videos uploaded by users and delete videos. In view of the problems described above, this paper focuses on how to use the internal information of video in the video community environment to effectively solve the problems mentioned above.

1. Introduction

With the continuous development of computer network technology, video resources have become an important resource in the network, and the related video resource management system functions have been greatly enriched video resource management system. These service modules are independent of each other and have different service functions. However, the data between these modules are widely correlated, so the interaction between data can be used to realize the collaboration between modules [1]. The data models of business modules differ greatly and the information cannot be expressed. However, in different service modules, the same data expressionwill increase the difficulty and complexity of system maintenance. The business development of video resource management system is restricted to extent. In addition, each business module of the existing system uses its own design interface to carry on the information interaction between different modules. In practice, however, this approach is characterized by the need for passive adaptation [2, 3].

At present, computer network is the core of the information age, and technology and economic development jointly promote the combination of various technologies, such as software and hardware technology and communication technology and accelerate the progress of the society as a whole [4]. As a typical information technology, the Internet of Things has been widely used in all aspects of people's life, such as public health, public security, education, and other fields. As a technology involving multiple fields and disciplines, the data management of video websites is also an important field of the application of the Internet of Things. Since the 1990s, computer network has experienced a process of rapid development, video website data management also gradually developed, which combines traditional automation theory with new computer technology [4, 5].

With the rapid development of computer technology, network technology, and multimedia technology, the information processed by computer has been expanded from traditional plain text information to multimedia information such as audio and video. Visual information accounts for more than 70% of all information received by human beings. Images contain more intuitive information than other forms of information. Therefore, it is more easily accepted by people of different cultures and overcomes the disadvantages of the traditional monitor installation process [6]. Disadvantages, such as limited transmission distance, make the equipment monitoring reach a new high degree of equipment monitoring which is no longer limited to text information monitoring . The staff can break through the regional limitations; it can understand the site situation more timely and accurately and effectively improve the system work efficiency. Modern remote monitoring technology combines video monitoring with data monitoring, makes full use of the advantages of all kinds of technologies, breaks the geographical restrictions, and effectively promotes the realization of ubiquitous network. The application of the Internet of Things will be more and more widely spread to all fields [7, 8].

In today's highly developed information, information acquisition is more convenient, information sharing has become the norm, and the application of digital technology makes information collection and storage more and more convenient. Modern society is to emphasize the information of the society, is especially important with the observation records, whether national classics in the economic field or in the national defense and military field, the one who has the right to know information first will have the leading power to develop vigorously. Human beings are entering an era of explosive increase in the amount of information and complex and diverse forms of information. In this context, observation record has a new interpretation and extension [9]. Then new form of data representation is introduced which is given in the next paragraph.

As a new form of data representation, video can retain the original information to the maximum extent and contain rich objects and scenes, becoming a common information carrier. Video recording is a good method of observation and recording. Compared with the traditional method based on human eyes and written records, it has the following advantages [10–12]:

(1) A wider range of observation fields and field video observation and recording are collected by camera nodes, whose camera nodes are equivalent to human eyes, making up for the limitations of human eye observation, and can record the scene from multiple angles, all-round and all-weather.

(2) The recorded data are more real and sufficient; as a group of people with social attributes, subjective emotions are more or less integrated into the observation record. Everyone tend to choose the observation record of the content they pay attention to, which often makes the record limited. Video observation and recording use cameras to record the scene objectively and in real time. Compared with human observation and recording, its data are more real and comprehensive.

(3) Recorded data have huge potential information mining value. Video is a kind of comprehensive and complex multimedia data integrating pictures, sound, and text, which contains rich and extensive information. By using advanced data processing technology, we can dig out valuable information from it, which is incomparable to written records.

The adoption of video observation recording is faced with a new severe problem, how to record videos with large amount of data and unstructured features of multiple observation nodes, as shown in Figure 1. Although the content of written recording is simple, it is structured in accordance with the record data in a regular form, so that the recorded results are clear at a glance and facilitate information exchange, a large number of video data have been obtained by using video observation records. Irregular data are classified and recorded and stored in a pot of porridge, which not only brings serious pressure to data storage and maintenance but also poses severe challenges to the workload of information retrieval data mining, making recorded data unable to be quickly used for analysis and processing and seriously hindering video management and marketing.

Therefore, with the expansion of business, the construction cost and system upgrade cycle and difficulty of video resource management system have increased exponentially. Because of the above problems, it is of great significance and research value to design a management and marketing system that can provide a unified format for video information access. This paper intends to design the system architecture of the video resource management system and establish the model of the video data management platform to build the application layer module of the system based on the platform and provide a unified format of data service interface description specification, so as to solve the data management and marketing in the video resource under the background of big data. This architecture can improve the system scalability and development efficiency to a certain extent [13].

The innovations of this paper are as follows:

(1) Design the system architecture of the video resource management system, study and build the model of the video data management platform, and build the application layer module of the system.

(2) Provide a unified data format description service interface specification, so as to solve the data management and marketing problems of video resources in the context of big data.

(3) The architecture improves the scalability and development efficiency of the system to a certain extent.

2. Related Work

In recent years, audio and video and other multimedia information on network transmission methods mainly include downloading and streaming transmission [14], because the sound of video file size generally decreases, while the network bandwidth is limited, traditional way of downloading is to download the complete audio and video

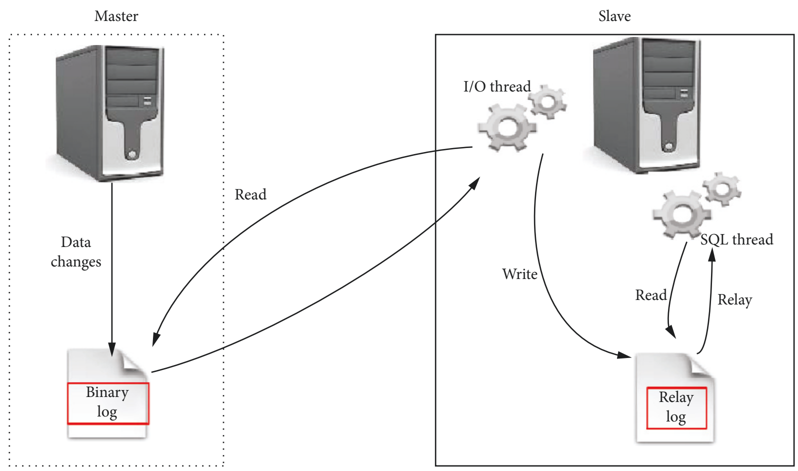


Figure 1: Principle of database from multiple observation nodes.

files which can be played; this may cause delay for a few minutes or even hours; download time and magnetic disk space waste bring a lot of inconvenience; The streaming data stream can be transmitted and played at the same time [15]. It only needs to store the first half of the content to play, but there is a time lag at first. This way not only shortens the delay but also saves the cache space and makes the user wait time sharply reduced. Therefore, compared with traditional media, streaming media has better performance in terms of delay. The client only needs to wait for the cache delay of streaming media data in the preparation stage. During transmission, multimedia content is successively downloaded from the server to the cache area of the client, realizing the simultaneous download and playback. Compared with traditional media technology, streaming media technology has the following three advantages: shortened startup delay, saving storage space, and file copyright protection [16, 17].

In the triple play under the help of the Internet of Things technology, streaming media technology in many industries is implemented in the field of application [18]. Video surveillance refers to the dynamic monitoring of video information in related areas, which is intuitive, convenient, and detailed. It is widely used in equipment operation, traffic inspection, and other fields in residential areas and has become an important means of security prevention in various fields such as national defense, public security, traffic, and commerce [19]. Video monitoring has undergone three important changes: the first one is local analog video signal monitoring, which has a small application scope due to the shortcomings of short transmission distance and difficult image preservation. The second is the digital video monitoring based on PC, which improves the image storage, but the complex system construction cost is too high, which hinders its promotion [20]. The third one is IP-based multimedia video surveillance, which uses Internet to share resources and lays a foundation for remote video surveillance. It is an effective and low-cost management method to establish a remote monitoring platform to monitor the running status of the equipment in real time. It can easily master the running status of the remote equipment and timely understand the working status of the equipment. The operation of equipment in remote areas can be mastered in real time, reducing monitoring costs and loss caused by accidents. On the other hand, it can also urge operators to operate reasonably and reduce accident incidence [21].

Video observation and recording system involves video collection, video storage, video retrieval, and video data processing and other related technologies. Few research institutions have systematically described its development process. Starting from the realization of observation and recording system based on multiple video nodes, this paper discusses the video collection technology and video management technology involving video retrieval technology which is mainly studied. The camera acquisition technology has gone through three stages: analog acquisition, digital acquisition, and network acquisition [22]. The main difference between them lies in different data transmission modes: analog acquisition technology directly transmits analog signals through signal cables; digital acquisition technology digitizes the data and then transmits it [23]; network acquisition relies on network to transmit digital signals. However, in the form of file storage for the unit [24]. With the development of computer technology, database management mode began to appear in the 1960s, relational data management model became the first database management mode, it uses hierarchical network and relational model to achieve text management of simple data types such as numerical values [25]. In the 1980s, database began to develop towards multimedia data management. In the 1990s, extended relational and object-oriented data management models appeared. Extended relational is based on the relational data model, which expands the data type from Boolean value of numeric string to image, audio, and video. Hypermedia technology is a new data management model that is being researched based on nodes and chains [26]. For unrestricted data structures, each node can store text images, videos, and other types of data. These network data nodes have rich statistical features and other superior performance [27].

In terms of video management technology and video retrieval technology, foreign countries still firmly hold the leading position in terms of video frequency management technology; compared with many well-known foreign database systems, domestic databases still have a big gap in data model data security and other aspects. The Dream OpenBASE Domestic data management system represented by Shenzhou OSCAR Jincang KingbaseES is gradually maturing, which has made breakthrough progress in big data management [14]. In the aspect of video retrieval technology, the information retrieval system MIRES developed by the Institute of Computing Technology of Chinese Academy of Sciences and the National Library of China can realize content-based video retrieval. Zhejiang University took the lead in the field of hypermedia research and achieved corresponding results [28]. Overall, these technologies have made rapid development, however, due to its related theory and technology is not very mature, there are still many problems to be solved in practical application.

Along with the vigorous development of the Internet, the Internet presents the explosive growth of data. Classification based method is one of the most widely used data management methods at present. At the earliest, when the Internet was not born, the management of the books in the library was based on classification [29]. When the amount of information increases sharply, the classification based data organization method will face the problem that the amount of data in the same category is still very large. Therefore, in order to accurately find the user's target information, personalization of online content is one of the most important aspects of the concept of personalization; it refers to the network users being free to publish their own rich media content. In order to solve this problem, a lot of related works have been put forward. And, in all of these works, the most widely studied and the application of the recommendation algorithm are worthy of collaborative filtering algorithm. The main research object of memory-based collaborative filtering algorithm is how to find similar users or similar recommended items and make recommendations according to such similarity. The recommendation algorithm based on memory can be divided into user-based ones and project-based ones.

It can solve the recommendation deficiency of memory-based algorithms and is more suitable for real-world data characteristics. Generally speaking, classification model is more suitable for solving the problem of classification information discrimination by users, while regression model is more suitable for user evaluation. In addition to memory-based and model-based collaborative recommendation algorithms, considering that context information may play a more accurate role in describing users' interests in the recommendation process, various external content information is combined into collaborative filtering algorithms, resulting in the emergence of content-based collaborative filtering algorithms. In this kind of algorithm, the context information considered by the recommendation system includes the text information of the web page of the recommended item, the network address, the news, and the network log. Based on this information, more accurate classifiers or heuristic algorithms can be applied to recommendation problems. However, this content-based recommendation algorithm has a serious problem, which is the cold start problem. Only when enough information is collected, this kind of algorithm can construct an accurate and reliable classifier. At the same time, due to the consideration of a large amount of external information, the computational complexity of this recommendation system is relatively huge. Protecting video copyright is not only the legal right of video copyright owner but also the strong guarantee of network video security. As Internet copyright is valued, digital piracy is becoming less and less likely.

3. Data Management and Marketing of Interactive Video Websites

3.1. The Flow Chart of the Proposed Method. However, with the increasing of equipment types, new pressure also appears. Due to the different status parameters of equipment, each type of equipment needs a monitoring system to realize the remote monitoring of corresponding status parameters, resulting in the problems of disordered monitoring system development, system reuse, and high development cost. On the other hand, many monitoring websites only provide separate video monitoring or data monitoring functions, which cannot achieve unified management of data and video of production equipment. Relying on the advantages of modern remote monitoring technology, this topic tries to develop the remote equipment monitoring platform repeatedly. Low utilization rate of weight of software development and equipment monitoring management are not unified and so on and so forth to provide a solution, through the configuration device status information, implementation of a scalable management platform, and improve the reusability of remote monitoring system and reduce the development cost of equipment access. The whole system of the method is given in Figure 2.

The status data and video data of the terminal device are collected and processed by the data collection device and sent to the corresponding server. Users can access the website through the browser and request the corresponding system management data through the web server and manage the data monitoring information accordingly. The data preprocessing service of web server provides some basic data preprocessing functions. By selecting the corresponding data preprocessing method, the user can get the corresponding data preprocessing results. The video data is accessed through the player, and the player is responsible for the interaction with the video server.

3.2. Data Preparation Processes. Numerical normalization can eliminate the gap between values and keep the variation range of each parameter within a certain range. However, its disadvantage is that it may be affected by a larger data in the parameter, making the gap of other data smaller after normalization. The variance normalization method pays more attention to highlighting the variation range of data:

$$y_i = \frac{x_i}{x_{\max}}, \quad (i = 1, 2, \ldots, n),$$
$$y_i = \frac{x_i - x_{\min}}{x_{\max} - x_{\min}}, \quad (i = 1, 2, \ldots, n). \tag{1}$$

The transformation formula of variance normalization is shown in the following formula:

$$\mathrm{y}_i = \frac{x_i - \overline{x}}{\sqrt{V}}, \quad (i = 1, 2, \ldots, n). \tag{2}$$

Then, data standardization refers to the scaling of data to a range. In order to facilitate the comparison or weighting of data of different units and levels, units are often converted to numerical comparison. There are three commonly used data standardization methods: minimum-maximization standardization according to decimal scale standardization and Z-score standardization:

$$v' = \frac{v - m_A}{M_A - m_A}\left(M_{A_{\text{new}}} - m_{A_{\text{new}}}\right) + m_{A_{\text{new}}}, \tag{3}$$

where M_A and m_A are the maximum and minimum values of attribute A, respectively. Z-score standardization is shown in the following formula:

$$v' = \frac{(v - \overline{A})}{\sigma_A}. \tag{4}$$

The standardization of decimal scaling is shown in the following equation:

$$v' = \frac{v}{10^k}. \tag{5}$$

Mean smoothing method is to eliminate mutation sample points by averaging sample points and their surrounding sample points. Window-moving average method and window-moving polynomial least square fitting method are both mean smoothing methods. The principle of window-moving average smoothing is as follows: noise generation has randomness, and part of noise can be reduced by positive and negative cancellation for multiple measurement results. Window-moving average smoothing method is the average of data in time, as shown in the following equation:

$$x_{i,\text{after}} = \frac{\sum_{i=1}^{n} x_{i,\text{before}}}{N}, \quad (i = 1, 2, \ldots, n). \tag{6}$$

Then, simple window-moving smoothing method to process N sample points is to calculate the mean of the sample points to be processed together with the left and right m samples, and its smoothing formula is shown in the following formula

$$x_{i,\text{after}} = \frac{\sum_{j=-m}^{m} x_{i+j,\text{before}}}{N}, \quad (i = m + 1, \ldots, n - m). \tag{7}$$

$$F(\omega) = \int_{-\infty}^{+\infty} f(t) \exp(-j\omega t)\mathrm{d}t,$$
$$f(t) = \frac{1}{2\pi}\int_{-\infty}^{+\infty} F(\omega) \exp(j\omega t)\mathrm{d}\omega. \tag{8}$$

The formulas of discrete wavelet transform and inverse transform are shown in the following formulas, respectively:

$$W_f\left(2^j, 2^j k\right) = 2^{-j/2}\int_{-\infty}^{+\infty} f(t)\varphi\left(2^{-j}t - k\right)\mathrm{d}t, \tag{9}$$

$$f(t) = C\sum_{j=-\infty}^{+\infty}\sum_{k=-\infty}^{+\infty} W_f\left(2^j, 2^j k\right)\varphi_{(2^j,2^j k)}(t). \tag{10}$$

4. Experimental Results and Analysis

4.1. Test Platform Construction. The test platform of the system includes camera node and data recording center. The high-definition IP camera of Heng'an Company is used as camera node, and PC is used as the test platform of the system instead of the data recording center.

The CPU of the PC is Pentium(R) E5400 series, with a CPU frequency of 2.7 GHz. The operating memory of the PC is 2 GB Oracle10 g, programming environment for VS2010. System test is to verify the expected function of the design, in order to test the stability of the system. Function test of the system module mainly tests whether the function of camera node search data decoding of the system can run normally, and whether the function of generating video records and data reproduction in Oracle can run normally. The camera was connected to PC through network cable.

4.2. Experimental Results Analysis. The ability to process data concurrently is affected by the processing speed and memory size of the computer itself. The cache size and thread pool can be dynamically adjusted by the size of the data processing capacity to improve the data processing capacity. Navicat is used to execute SQL query, and the number of information processed per second is calculated according to time groups. Taking the processing result of 80 threads as an example, the results are shown in Figure 3. The graph results show that under the current test environment and bar, the number of information processed per second is more in the range of 30~35. That is, if no cache is set or the cache is small, the number of concurrent data can be received about 30~35. By setting a larger cache and improving the performance of the system server, the number of concurrent data can be received to a certain extent.

The video player has two playback modes, which can be used to play local files or receive streaming media data. When the streaming media playback mode is enabled, the video stream can be obtained from the video forwarding server. The playback effect is shown in Figure 4(a). Local player can play files in various encoding formats, such as FLV MPEG-2 MPEG-4 H.264 MKV WebM WMV MP3. When you switch the player mode to local play, the local video is played as shown in Figure 4(b):

In both modes, the video can be paused and stopped. The above test shows that the whole video forwarding service and the playback system can work normally. The database tables store the description of video data, and the selection of table content should be representative to facilitate the classification and description of video data and easy extraction. The

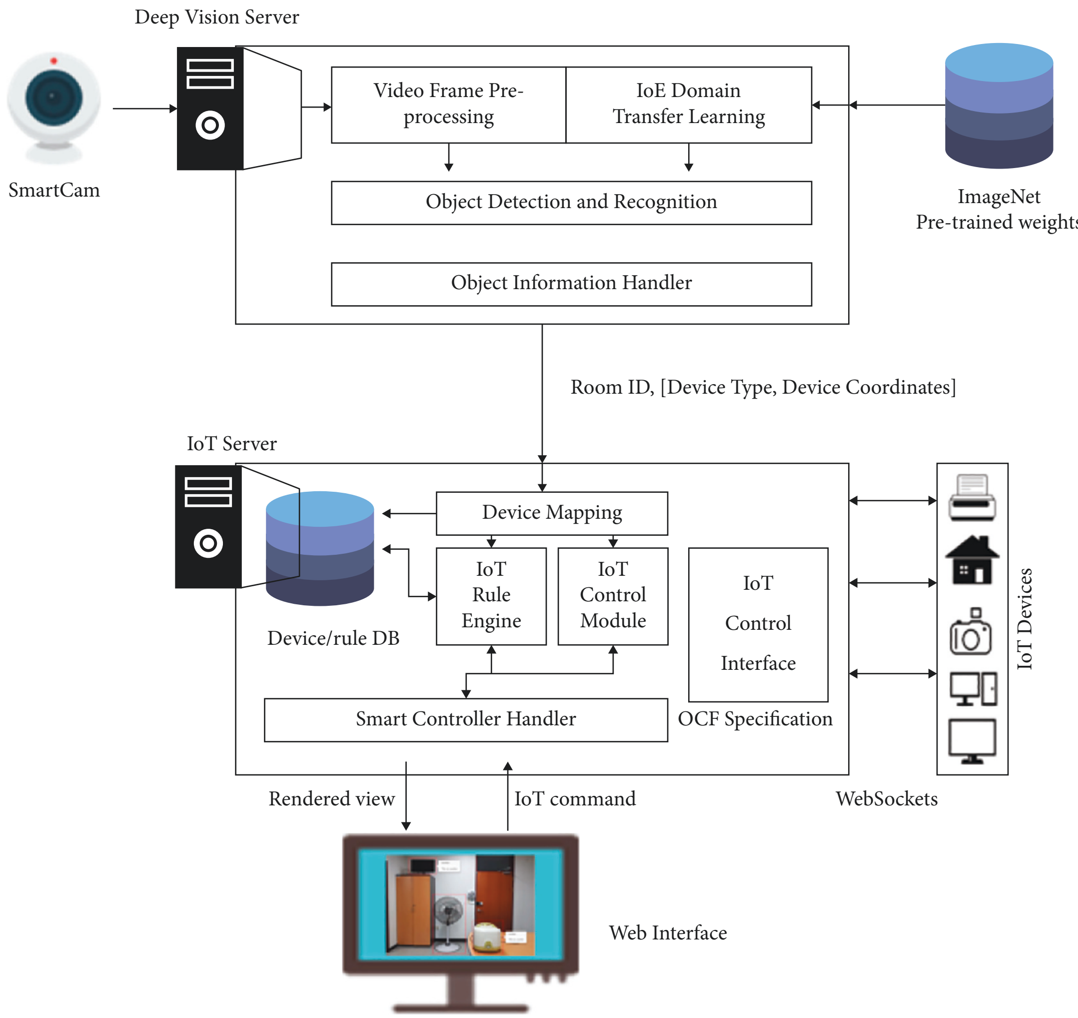


Figure 2: Flow chart of the proposed data management and marketing method.

video management model is proposed to describe video data according to Figure 4, so the table content mainly includes the key frame structure of basic video attributes information about underlying characteristics and raw data. It has been proved that according to the selected table content, the camera node record time can briefly classify the video data, the key frame summary and data structure can roughly describe the video content, and the video data can realize the reproduction of the complete video. As shown in Figure 5, the relationship between the unknown region constraint conditions and the target region is formed by associating or associating the constraints. In the program, according to the constraint association form selected by users, the input constraints are combined and formed into SQL statements, which initiate retrieval requests to the database to retrieve the SQL implementation of the constraints.

The video node transmits data according to RTP/RTCP protocol, and the video data are encoded according to the protocol format. H.264 data are placed in the data segment of the RTP network packet. However, each frame of a 24-bit color image with resolution of 1920 1080 is about 10 kB in size even though it is encoded by H.264. Each RTP packet cannot transmit this many bytes of data, so one frame, H.264, encoded image is divided into many data units, and each data unit is encapsulated in an RTP packet for transmission. The output of data decoding includes YUV format video data key frame identifier key frame video resolution and data size frame size for each frame. The video resolution and YUV data are directly transmitted to the data display module, and the key frame identifier and data size of each frame are used to store the number of data in Oracle. The structure of the video was generated according to time.

CYUV is an image coding method based on brightness and chromaticity, where Y represents brightness signal, U and V represent chromaticity signal, it is very suitable for color image display, with the characteristics of small amount of data YUV format according to the brightness of the pixel point and chromaticity coding sampling frequency is divided into four: YUV444, YUV422, YUV411, and YUV420. Figure 6 shows four coding forms of YUV. Each box in the figure represents a pixel point. In YUV444, each pixel contains Y, U, and V components; in YUV422, every two pixels contain Y, U, and V components, 2 : 1 : 1; in YUV411, every four pixels contain Y, U, and V components. The

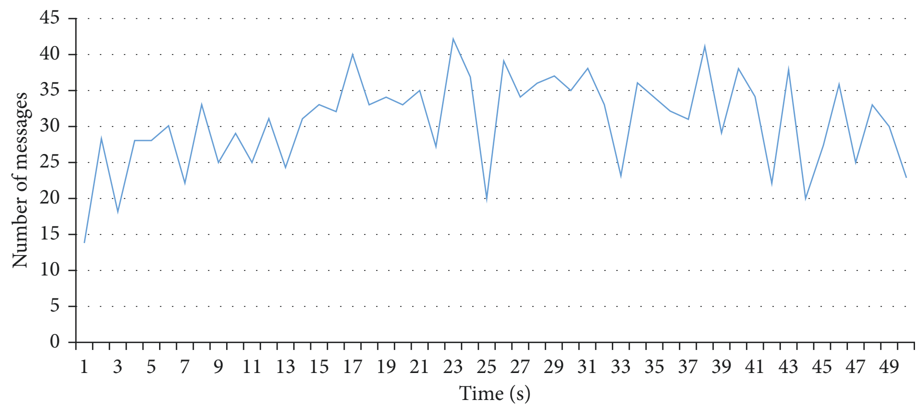
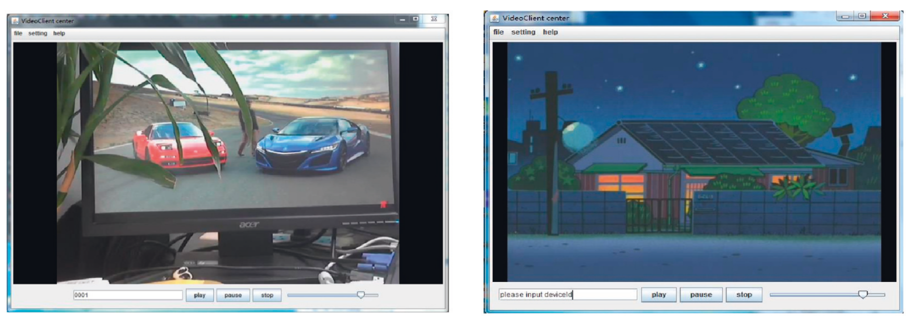
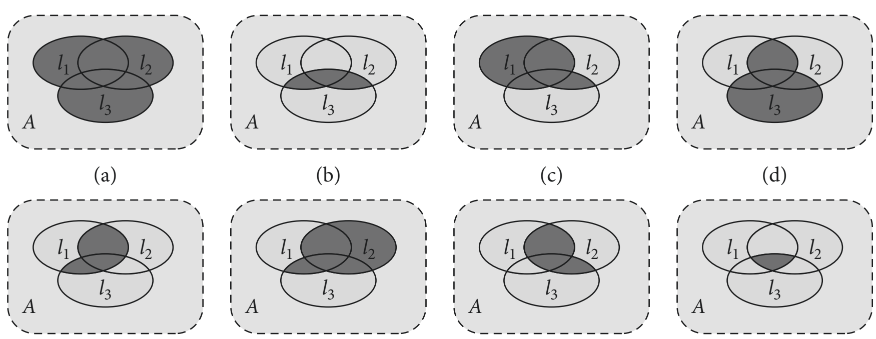


Figure 3: The amount of data processing received in relation to time.



(a) (b)

Figure 4: Effect of streaming media mode (a) and playing the effect picture of a local file (b).



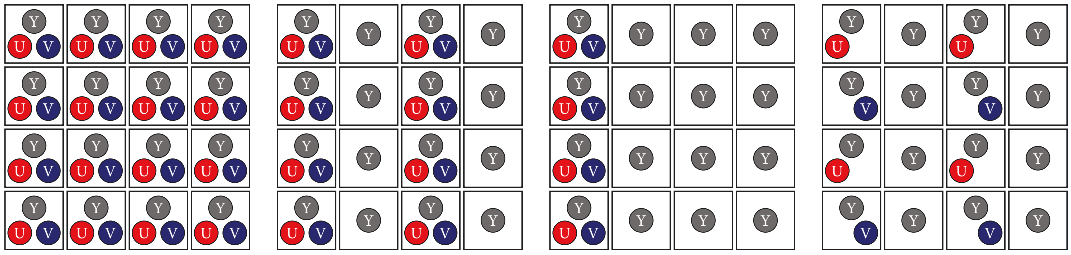
(a) (b) (c) (d) (e) (f) (g) (h)

Figure 5: Retrieving the association model of the constraints. (a) $l_1 \cup l_2 \cup l_3$, (b) $(l_1 \cup l_2) \cap l_3$, (c) $l_1 \cup (l_2 \cap l_3)$, (d) $(l_1 \cap l_2) \cup l_3$, (e) $l_1 \cap (l_2 \cup l_3)$, (f) $(l_1 \cap l_3) l_2$, (g) $(l_1 \cup l_3) \cap l_2$, and (h) $l_1 \cap l_2 \cap l_3$.

fraction is 4 : 1 : 1. In YUV420, U component and V component are extracted in interlaced lines.

In addition, the interactive video platform displayed on a red laptop is given in Figure 7. Experts can record the screen to video and add audio explanations, using a regular microphone and laptop. The expert can later record more in-depth modules of information on the parts of the training material that require further explanation. Then, these modules are connected by adding interactive spatial annotations as superpositions on video images using interactive video online platform.

Figure 8 shows a network interface where the video stream in the room is turned on and smart controllers for microwave and TV are activated. The UI that displays the smart controller is rendered according to the type of device selected. TV, on the other hand, has three properties: Binar Switch, Audio Control, and Channel Control. So, the TV's smart controller consists of three different button sets, from which we know that Figure 8(a) is the video health status before moving microwave; and Figure 8(b) is the video health status after moving the microwave oven.



(a) (b) (c) (d)

Figure 6: Four encoding forms of YUV. (a) YUV444, (b) YUV422, (c) YUV411, and (d) YUV420.

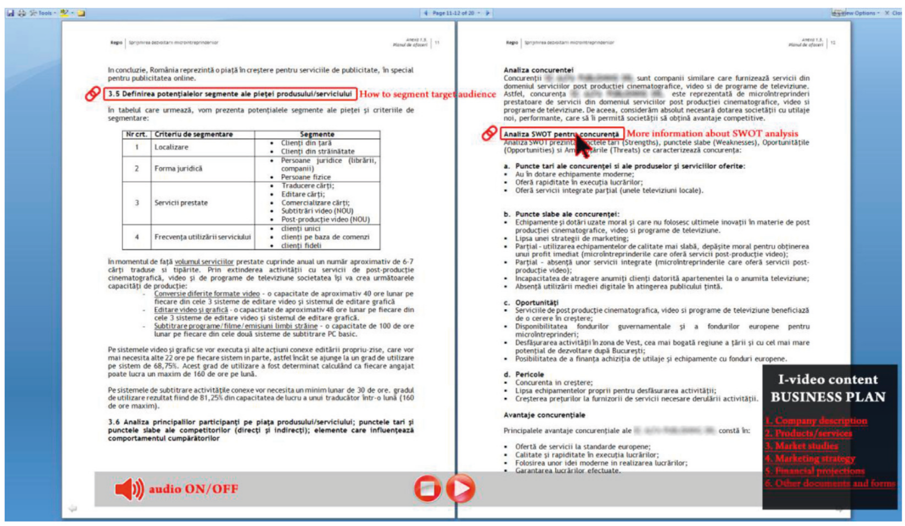
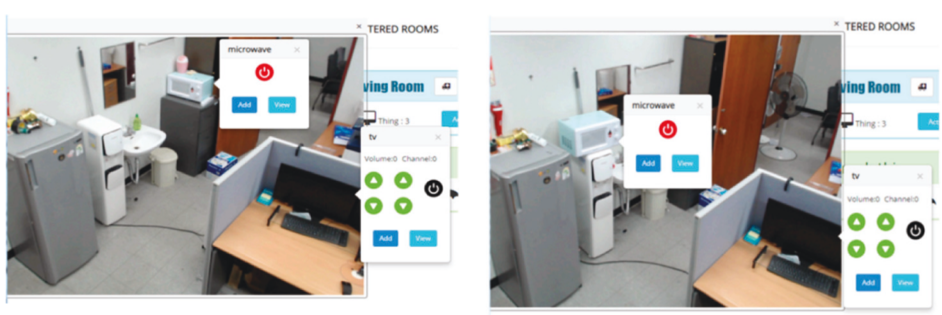


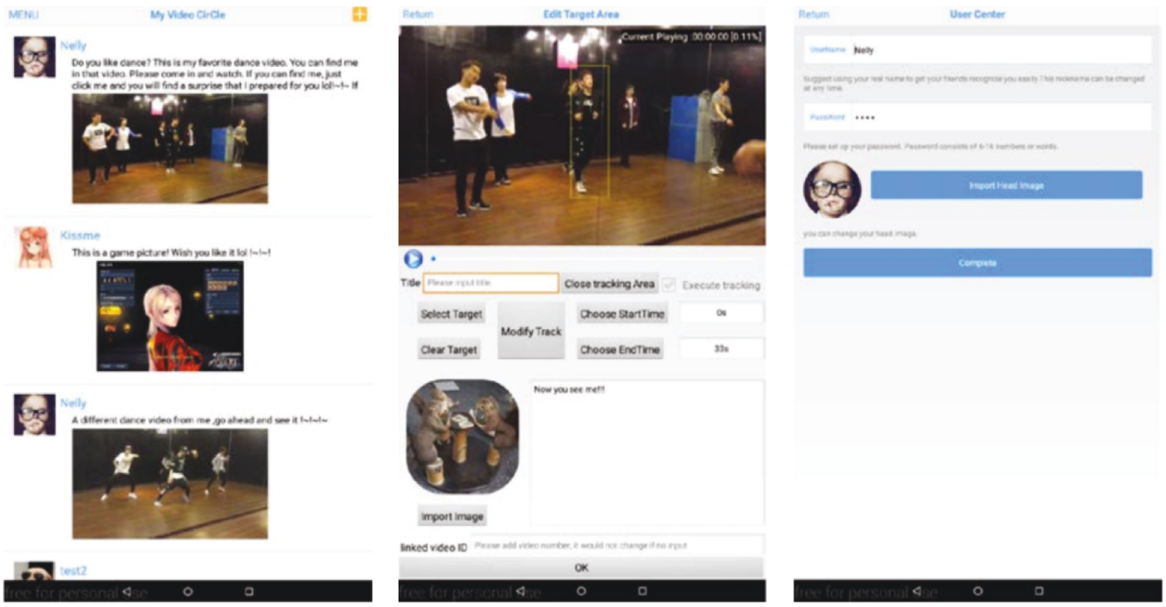
Figure 7: Interactive video platform displayed on a red laptop.



(a) (b)

Figure 8: Video health status: (a) before moving the microwave; (b) after moving the microwave oven.

Based on the abovementioned research, this paper develops an interactive video system based on Android. Users can use the phone's installed application to display the video view on the home page (see Figure 9(a)), as well as publish and edit the video in the editor module (Figure 9(b)). You can also change your username, password, and so on in the user center (see Figure 9(c)).



(a) (b) (c)

Figure 9: Interactive video has multiple application scenarios.

5. Conclusions

This article in view of the whole system design and implementation, from the perspective of application, puts forward a scalable video and data monitoring and management platform, and the sections discuss the platform to realize the key technology involved. This paper mainly includes the following respects: (1) database: according to the demand analysis, the database physical model is designed by Power Design, and the database design is completed by MySQL and Navicat; (2) web platform: the web platform is the realization of the data monitoring of the system, mainly providing the management and monitoring of all kinds of information, including the management and maintenance of user equipment video handover records and other information as well as the monitoring of equipment operation data; (3) video forwarding service: video forwarding service is mainly used to manage surveillance video data flow information, including receiving, storing, and forwarding, providing a solution for terminal video data management; (4) video player: C/S mode is adopted in the design of video forwarding service, and a video player is written to play the streaming media data sent by the video forwarding service center; (5) data preprocessing module: it provides several basic data preprocessing solutions for users and shows them intuitively through graphics, which can provide certain reference for users to view the law of data change and determine the subsequent data management scheme.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest or personal relationships that could have appeared to influence the work reported in this paper.

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